

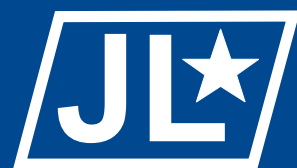
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Improving Bare Base Agile Combat Support

**A Comparative Analysis Between Land
Basing and Afloat Prepositioning of
Bare-Base Support Equipment**

Lieutenant Colonel Joseph E. Diana, USAF



In a tale of war, the reader's mind is filled with the fighting. The battle—with its vivid scenes, its moving incidents, its plain and tremendous results—excites imagination and commands attention. The eye is fixed on the fighting brigades as they move amid the smoke, on the swarming figures of the enemy, on the general, serene and determined, mounted in the middle of his staff. The long trailing line of communications is unnoticed. The fierce glory that plays on red, triumphant bayonets dazzles the observer, nor does he care to look behind to where, along a thousand miles of rail, road, and river, the convoys are crawling to the front in uninterrupted succession. Victory is the beautiful, bright coloured flower. Transport is the stem without which it could never have blossomed.

—Winston Churchill

Special Feature

Introduction

Air Force guidance is rife with statements on the importance of its expeditionary capability. As an example, in the 2003 Air Force Posture Statement, the term expeditionary occurs 30 times. In spite of a 30-percent reduction in service manpower over the last 12 years, the Air Force has experienced an exponential increase in worldwide taskings.¹ Deputy Secretary of Defense Paul Wolfowitz, in a prepared statement before the House and Senate Armed Services Committees, 3-4 October 2001, acknowledged the impact from the events of 11 September 2001 and the subsequent security environment. He stated, "A transformed force must be able to...project and sustain forces in distant access-denial environments." Two Air Force distinctive capabilities—rapid global mobility and agile combat support (ACS)—focus efforts further on making the Air Force as expeditionary as possible.² The term expeditionary is not specifically defined in Air Force doctrine but is understood to describe a capability to deploy rapidly anywhere in the world, quickly establish operations, and sustain those operations for as long as necessary. RAND's analysis of Air Force efforts in Operation Enduring Freedom and Operation Iraqi Freedom highlighted the challenges associated with rapidly deploying forces and initiating combat operations. This critique of the Air Force is not new. The Air Force has struggled with expeditionary operations since becoming a separate service. In the Korean and Vietnam conflicts, the Air Force's inability to deploy quickly and operate with a focused footprint resulted in the displeasure of the Secretary of Defense.³ As a result, the Air Force began to develop a better expeditionary capability. The Harvest Bare concept was born and has evolved into a robust, mobile expeditionary capability. Today, the Air Force has a variety of bare-base assets that can be tailored to meet service needs across the spectrum of conflict.

Yet, while these assets remain mobile, they are not agile, and the current prepositioning strategy is focused mainly on two regions of the world—the Korean peninsula and Southwest Asia. To improve Air Force agility in establishing bare-base operations, RAND and the Air Force Logistics Management Agency (AFLMA) analyzed current conditions separately and recommended potential solutions. RAND's focus has been more on improving agile combat support and centered on establishing forward operating locations (FOL) and forward support locations (FSL).

While their research is not focused on staging bare-base assets, using forward support locations puts key bare-base assets within 3,000 miles of any geographic location. Conversely, AFLMA focused its research on adding a sealift component for bare-base assets similar to the concept currently used for munitions. Its research centered on a cost-and-risk analysis comparing ship-basing and land-basing of bare-base assets. These two studies provide key strategies for improving the Air Force's ability to rapidly project expeditionary air forces anywhere in the world. This article compares the results of these two studies to determine which is the best option for meeting the needs of the expeditionary air force.

The yardstick used to make that determination should be based on stated requirements for the Air Force. Those

However, Enduring Freedom and Iraqi Freedom saw operations move to much more austere locations like Bagram AB, Afghanistan, and Ganci AB, Kyrgyzstan. The authors of the RAND study *Supporting the EAF: A Global Infrastructure* call these category 3 bases where the main assets are a runway, source of water, and source of fuel.⁸ The Air Force will continue to project power to these category 3 bases for the foreseeable future.

Projecting power to these category 3 bases requires bare-base assets. Bare-base assets include three main components. First and foremost are the *Harvest* sets that provide living and working shelters and the utility infrastructure to sustain operations. There are currently five types of Harvest sets, and they can be scaled to meet Air Force requirements across the spectrum of conflict. The largest Harvest set can support 1,000 persons and requires more than 250 trucks to move. In addition to the Harvest sets, special purpose vehicles and equipment are needed. These include R-9 refueling trucks, airbase defense vehicles, emergency response vehicles, and construction vehicles needed to set up a base. The last major component for bare-base operations is the special purpose equipment. Special purpose equipment includes aerospace ground equipment, munitions materiel-handling equipment, and equipment needed by civil engineers. These three components comprise the basics of any bare-base capability but are not all-inclusive. Munitions, external tanks, munitions racks,

To improve Air Force agility in establishing bare base operations, RAND and the Air Force Logistics Management Agency analyzed current conditions separately and recommended potential solutions.

requirements start with the National Security Strategy and flow down to Air Force doctrine and keystone publications. Distilling those many documents results in four key areas for evaluation: responsiveness, readiness, supportability, and cost.

Background

We move on time lines that simply will not work if we have to wait for support for our expeditionary forces.

—General Ronald R. Fogleman, USAF

Air Force Requirements for Bare Basing

Requirements for an agile bare-base concept for the Air Force exist in a variety of documents. The National Security Strategy requires the Department of Defense (DoD) to continue to transform the military forces to ensure the ability to conduct rapid and precise operations anywhere in the world to achieve decisive results.⁴ The 2003 Air Force Posture Statement reminds airmen that the nature of the Air Force is not home-station operations but deployed operations.⁵ In 2003, the Air Force was deployed to more than 40 countries.⁶ But where do these forces deploy? It has been more than a decade since the DoD began reducing overseas main operating bases. In the 1990s, primary expeditionary operations were to warm⁷ forward operating bases like Prince Sultan AB, Saudi Arabia, or Incirlik AB, Turkey.

and adapters, as well as bulk petroleum, are other key components to sustaining combat sortie operations. The focus of this article, however, is on the bare-base components of Harvest sets, special purpose vehicles, and special purpose equipment and the best way to store and maintain these items so they can be rapidly deployed to support combat operations.

Being Expeditionary

Based on the presence of Air Force units deployed to 44 deployment locations in 2003, no one can argue the expeditionary nature of the Air Force. However, being able to project forces is only one part of being expeditionary. The Air Force must be able to project those forces rapidly. The current air and space expeditionary force (AEF) goal—establishing combat sortie operations at any bare-base location in the world 5 days after the deployment starts—constitutes a challenge that the Air Force has yet to overcome.⁹ For example, for various reasons, not a single Enduring Freedom location was able to achieve this goal. Even with some bases in the region having US forces present and others possessing little more than a runway, the Air Force struggled to become operational quickly. Diego Garcia, a base well known to Air Force units and operated by the British Royal Air Force, was operational in 17 days. Units deployed to Jacobabad, Pakistan, required 73 days to prepare the site, establish force protection measures, repair deteriorating parking ramps, set up communications, and construct munitions

pads, as well as a tent city.¹⁰ RAND's analysis of the Air Force's ability to rapidly deploy raises concern.

A Look at Two Proposals

The RAND Corporation and AFLMA each have conducted extensive research to help identify ways to make the Air Force more expeditionary.

RAND Corporation Study

RAND conducted a series of studies evaluating the ACS capabilities of the Air Force. The focus of these studies was not limited to initial operations at bare bases but also included sustainment of combat operations. RAND's primary contention was that five basic components could best serve agile combat support: forward operating locations, forward support locations, continental United States (CONUS) support locations, a responsive transportation system, and a combat support C2 system.¹¹ RAND divided the forward operating locations into three categories based on their infrastructure:

- A **category-3** forward operating location is a *bare base*. It meets only the minimum requirements to operate a small fighter package (runway, fuel, and water). It would take almost a week (144 hours) to be able support aerospace expeditionary wing (AEW) high-sortie generation rates.
- A **category-2** base has the same support facilities as a category-3 base plus prepared space for fuel storage facilities, a fuel distribution system, general-purpose vehicles (host-nation provided or rented), and basic shelter. It may take up to 96 hours before a category-2 base could support AEW high-sortie generation rates.
- A **category-1** base has all the attributes of a category-2 base, plus an aircraft-arresting system and munitions buildup and storage sites already set up, and 3 days' worth of prepositioned munitions. Such a base could be ready within 48 hours of the execution order to support high AEW sortie generation requirements.¹²

Because each category of forward operating location requires differing amounts of equipment to prepare the base for operations, RAND proposed two options for supplying these resources: forward support locations in or near the theater of operations and CONUS support locations.

An FSL can be a storage location for US war reserve materiel (WRM), a repair location for selected avionics or engine maintenance actions, a transportation hub, or a combination thereof. It could be staffed permanently by US military or host-nation nationals or simply be a warehouse operation until activated. The exact capability of a forward support location will be determined by the forces it will potentially support and by the risks and costs of positioning specific capabilities at its locations.¹³

RAND, in a subsequent study, refined the FSL concept with specific recommendations for locations (Figure 1):

A small number of forward support locations in Alaska, Guam, Puerto Rico, Diego Garcia, and the United Kingdom could put most of the world within range of a C-130 carrying a 12-ton payload of supplies and equipment. Those in Alaska, Guam, and Puerto Rico, being on sovereign US territory, would offer assured access. Assured access is available on Diego Garcia until at least 2039. Forward support locations in the United Kingdom do not offer completely assured access, but they would be on the territory of the most reliable US ally.

Article Highlights

Base-base operations and bare-base assets are key to making expeditionary airpower and agile combat support a reality. This article compares the recommendations of two separate agile combat support study efforts and offers an overall recommendation concerning the best choice based on responsiveness, readiness, supportability, and cost. The first study, conducted by RAND, focused on improving agile combat support by suggesting network of land-based sites—forward support locations. The second study, conducted by the Air Force Logistics Management Agency, takes a different tactic. It suggests adding a prepositioned sealift component for bare base assets similar to the one currently used for munitions. These two studies provide key strategies to improve the Air Force's ability to project expeditionary airpower rapidly anywhere in the world. The focus of this article is determining the best option for meeting the needs of the Air Force. It advocates that an afloat option has sufficient merit across the spectrum of readiness, responsiveness, supportability and cost to make it the better choice.

While RAND and the AFLMA offer differing views concerning bare-base assets, they have worked collectively under the sponsorship of the Air Staff on a variety of agile combat support efforts.

All would be outside the range of the offensive capabilities of likely future adversaries.¹⁵

In sum, this geographic arrangement using forward support locations is the basis of this article for analysis of a future support system for bare-base equipment staging.

AFLMA Study

In contrast to RAND's land-based recommendations for forward support locations, AFLMA conducted an analysis on an afloat prepositioning concept for bare-base assets. The study had four primary purposes. First, complete a two-part cost-benefit analysis consisting of an analysis of day-to-day peacetime operations and a similar analysis of wartime requirements between the Air Force's current land-based prepositioning posture and a combination of land-based and afloat prepositioning posture. Second, develop a decision support tool to determine when to use assets prepositioned on ships. Third, compile information on how well assets are maintained on both Army and Marine Corps prepositioning ships. Finally, compile reliability data on Military Sealift Command (MSC) prepositioning ships.¹⁶ Their analysis was based on the beddown of a single air expeditionary wing.

AFLMA concluded that, during peacetime, expenditures for afloat prepositioning exceeded those for land-based prepositioning but, during wartime, the ship-based concept quickly paid for itself. In terms of force closure timing, analysis indicated that equipment aboard the ships was delivered to the operating location within required time lines. The net impact of the nonmunitions WRM afloat prepositioning ship shortened force closure timing by 1 to 2 days over the first 15 days of the operation. Finally, with regard to affordability, purchasing \$71M in new equipment to simply put on the ship was deemed to be cost prohibitive based on past Air Force WRM appropriations.¹⁷

AFLMA refined the study in April 2003 to further examine the risk to Central Command's operational plans (OPLAN 1003-98) to place nonmunitions WRM afloat and presented an implementation plan for sourcing the assets to be stored on the ship from currently assigned WRM assets.¹⁸ The resources identified were US Central Command's (CENTCOM) assets that were malpositioned (not stored at the right location or in excess of requirements). This sourcing was done to overcome the issues with affordability of the \$71M in equipment needed to configure the ship. They continued to recommend a minimum of at least one ship, possibly two, dedicated to nonmunitions WRM items.

Evaluation Criteria

Which of the two studies discussed best meets the Air Force needs? As previously discussed, Air Force capabilities flow from the *National Security Strategy* and the *National Military Strategy*. These two documents stress the importance of quickly responding to world events. Therefore, responsiveness is a key criterion. Responding quickly is a function of readiness. Readiness is the second criterion. The fiscal realities of today's budget environment require any capability to be affordable and sustainable. This leads to the final two criteria: supportability and cost. Therefore, four criteria will be used for evaluation: responsiveness, readiness, supportability, and cost. Identifying the criteria requires an explanation of what considerations are involved in each.

Responsiveness

Responsiveness measures the ability of each option to meet requirements driven by contingency taskings. Taskings should not be limited to specific operational plans but should consider the possibility of worldwide contingencies or deployments. Evaluation of this capability must consider a potential

adversary's antiaccess measures.

It must consider secondary transportation requirements to deliver bare-base assets to their ultimate destination. Finally, how quickly an option can be implemented must be evaluated.

Readiness

The concept of readiness includes the level of maintenance support required to keep bare-base assets ready for use in each option. This includes how frequently maintenance will be performed and how accessible the assets will be for maintenance actions under each option. Readiness analysis will consider how successful the maintenance program would be in terms of access to skilled technicians, spare parts, and the impact of environmental factors on the items. Finally, readiness will

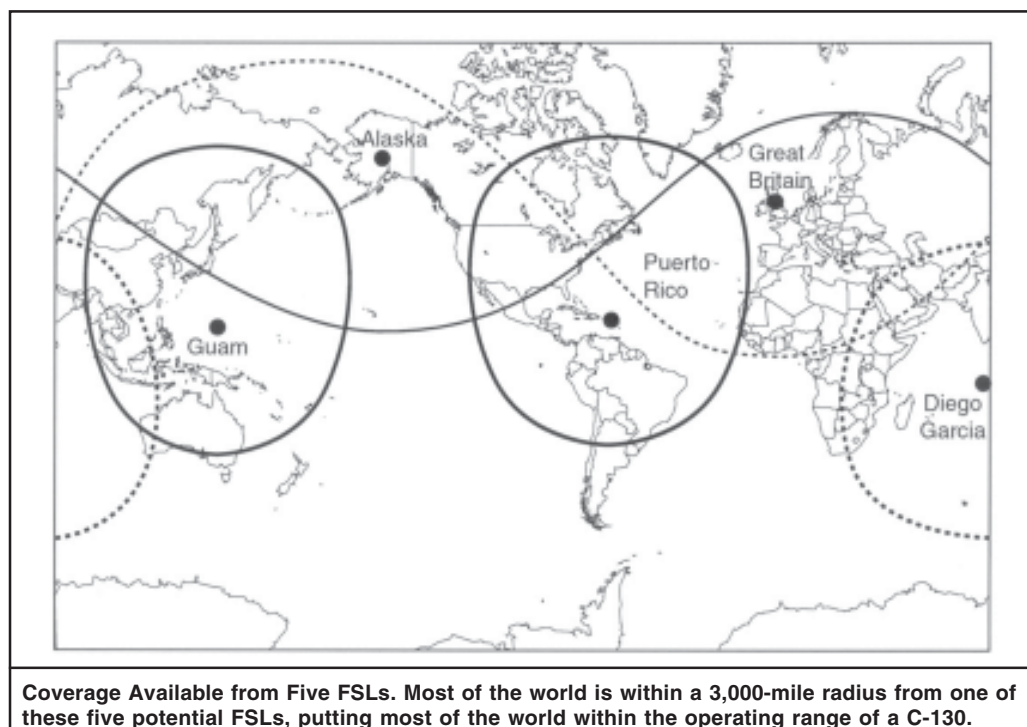


Figure 1. Forward Support Locations Providing Global Coverage¹⁴

consider how visible and measurable the assets will be to senior leaders under each option.

Supportability

The criterion of supportability measures the ability of the Air Force to sustain either option over time. As mentioned before, a component of responsiveness should evaluate how quickly each option can be implemented fully. In measuring supportability, assessments will be made as to how likely Congress, combatant commanders, and the Services will be in supporting each option.

Cost

Cost is the final criterion. The peacetime costs involved in each option will be assessed. This will be focused primarily on the cost to initiate and sustain each option. Additionally, this article uses a comparison of the wartime cost for each option. Where pertinent, costs will be divided into fixed and variable components to help better determine which option is more economical.

Evaluating the Two Options

Streamlined infrastructure, time-definite delivery, total asset visibility, and a reduced mobility footprint are the four overarching planks of agile combat support. They're all focused on being able to "get out of Dodge" rapidly with resupply and sustainment starting as the force is ready to engage.

—Lieutenant General William P. Hallin, USAF

Air Force capabilities flow from the *National Security Strategy* and the *National Military Strategy*. These two documents stress the importance of being able to respond to world events quickly.

Having provided a brief description of the two plans for bare-base storage and the four criteria by which the two plans will be evaluated, it is now time to compare the two. Each option will be evaluated against specific criteria.

Responsiveness

AFLMA provides an excellent comparative analysis of the responsiveness of afloat prepositioning and movement of theater, land-based assets. The theater locations used by AFLMA do not specifically match the FSL locations proposed by RAND. However, they provide an excellent starting point for analysis and are actually closer to the conflict locations evaluated than any of RAND's proposed forward support locations. AFLMA analysis used two different criteria for comparison. First, they used specific locations identified in CENTCOM's OPLAN 1003-98 for comparison. Second, they chose a variety of contingency locations throughout the theater that were not tied to an operations plan.

For the first part of the analysis, AFLMA chose eight OPLAN Air Force locations that would require the delivery of bare-base assets. The locations are identified by number to address classification considerations. Also, because required delivery

date (RDD) information is classified, the team developed an unclassified measure based on the force closure times. This measure compares the percentage of required delivery dates met rather than the actual time it took to deliver the assets. Four transportation scenarios were run for each location. The scenarios and their justifications were:

- **Airlift**—airlift from the land-based source to the forward operating location. Only one transportation leg is involved.
- **Afloat**—In this option, the first transportation leg is sealift from tether (Diego Garcia) to port. The second leg is download port time at the destination port. The final leg is truck to the final destination.
- **Afloat Worst**—For the worst-case scenario, the team assumed port access was denied forcing the war reserve materiel to be downloaded at Diego Garcia and airlifted to the forward operating location. AFLMA recognized that a shortfall with this scenario was that it ignored the intermodal problem; that is, sealift and land utilize 20- or 40-foot containers, and airlift requires 463L pallets. For analysis, they assumed away the intermodal problem but recommended it for further study.
- **Theater Sealift**—US Central Command Air Force (CENTAF) planners informed AFLMA that, as a result of lessons from Iraqi Freedom, intratheater airlift for bare-base assets does not work. Prior to the start of hostilities, CENTAF moved bare-base assets exclusively by theater sealift. This option contained five transportation legs. The first leg trucked the equipment from source (the forward support location) to a port. The second leg was to be at port in time for loading. The third leg was sealift. The fourth leg was the download at the destination port. The final leg trucked the

equipment to the final destination.¹⁹ The results of AFLMA's analysis are depicted in Figure 2.

AFLMA offered the following comments on the results:

The results showed that, even with no strategic warning, many of the combatant commander's requirements can be met with equipment prepositioned afloat. The only locations where theater prepositioning offers an advantage is when airlift is the only option for movement—Bases 5, 6, and 7. Further analysis showed that the risk to the afloat option at these locations could be reduced to levels equal to that of the airlift option by either (1) securing additional line haul capability or (2) taking advantage of ambiguous warning. At Bases 5 and 6, using rail or additional line haul capability allows the afloat option to close as fast as the airlift option. At Base 7, only 4 days of ambiguous warning are needed to allow the afloat option to close as fast as the airlift option.

Analysis of past contingencies in the previous study showed that it is not unrealistic to assume that there will almost always be some degree of strategic warning prior to a contingency.²¹

In recognition of this assumption, additional analysis was performed with 7 days of strategic warning. The results are shown in Figure 3.

In summary, a comparison of prepositioned afloat and airlift in scenarios with and without strategic warning is shown in Table 1.

While OPLAN analysis is important, the Air Force deployment pattern has been more contingency driven than OPLAN specific. For the second part of the analysis, AFLMA chose a variety of non-OPLAN-specific locations within the CENTCOM area of responsibility (AOR). For the northern part of the AOR, AFLMA chose Bishkik, Kyrgyzstan; Dushanbe, Tajikistan; Kulyab, Tajikistan; Samarkund, Uzbekistan; Qarshi,

Uzbekistan; Jacobabad, Pakistan; and Bagram, Afghanistan. For the southern part of the AOR, AFLMA chose Cairo West, Egypt; Asmara, Eritrea; Djibouti, and Mombassa, Kenya. AFLMA chose specific ports of entry in each region to help focus its analysis.

For the southern region, the results are shown in Figure 4.

For the southern FOLs in the CENTCOM AOR, the afloat option overall closes faster than the airlift option, even with the overly restrictive assumptions for sealift and the overly optimistic assumptions for airlift. And clearly, the closer a port is to the destination location, the faster the afloat option can close. For

example, Cairo West is approximately 100 miles from Port Suez; and under the constraint of 12 tractor-trailers for line haul, the line-haul time is 21 days of the total 33 days required for closure. As the 12 tractor-trailer constraint is relaxed (that is, contracted line haul from host-nation support), the closure time dramatically shortens.²⁴

AFLMA gave an alternative in its analysis of the northern region locations. This was added because the time required to truck WRM from the port to the operating location was not acceptable. This alternative, the afloat + option, requires five C-17s to airlift the material from the disembarkation port to the operating location.²⁵ The results of this analysis are shown in Figure 5.

The closure times for the northern locations are driven by the restrictive assumptions on ground transportation. The fact is, these locations are not near ports. There are no good ground transportation options—simple railroad routes are not as available for these locations as for the other locations analyzed.²⁶

AFLMA's studies show that an afloat option is more capable of meeting force closure times than a land-based option, especially when some degree of strategic warning is received. In light of the fact that basing rights and overflight issues have to be resolved prior to any non-major theater war (MTW) event, it probably is realistic to expect that combatant commanders will have the foresight to get a ship headed toward its destination prior to the execution order.

AFLMA's analysis of closure estimates highlights that, regardless of the option, there

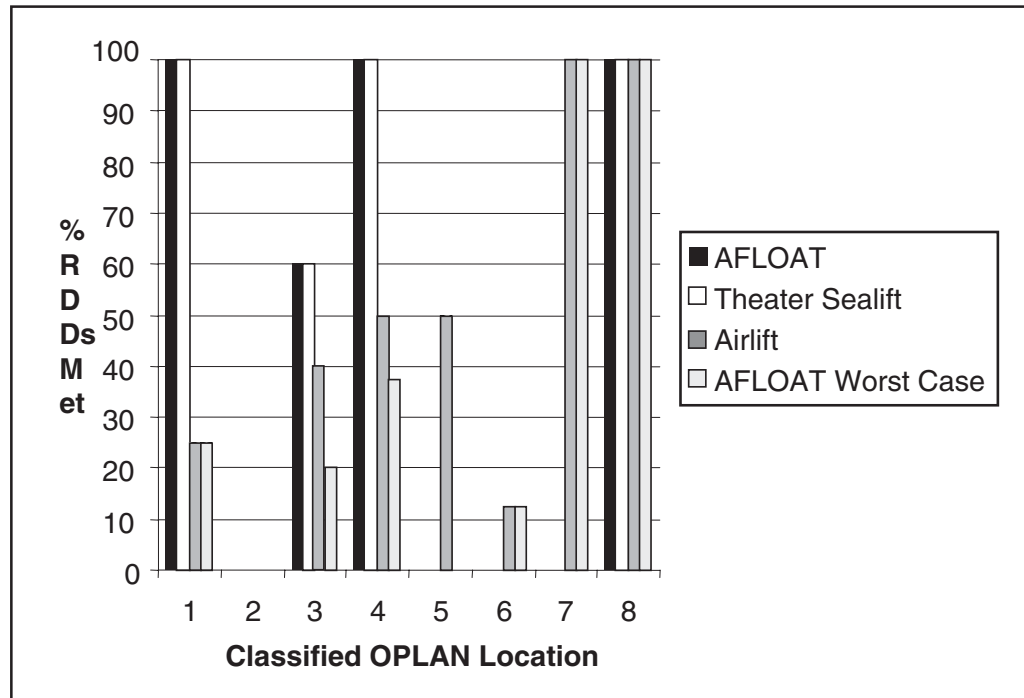


Figure 2. RDD Comparison Using Eight OPLAN Classified Locations (Without Strategic Warning)²⁰

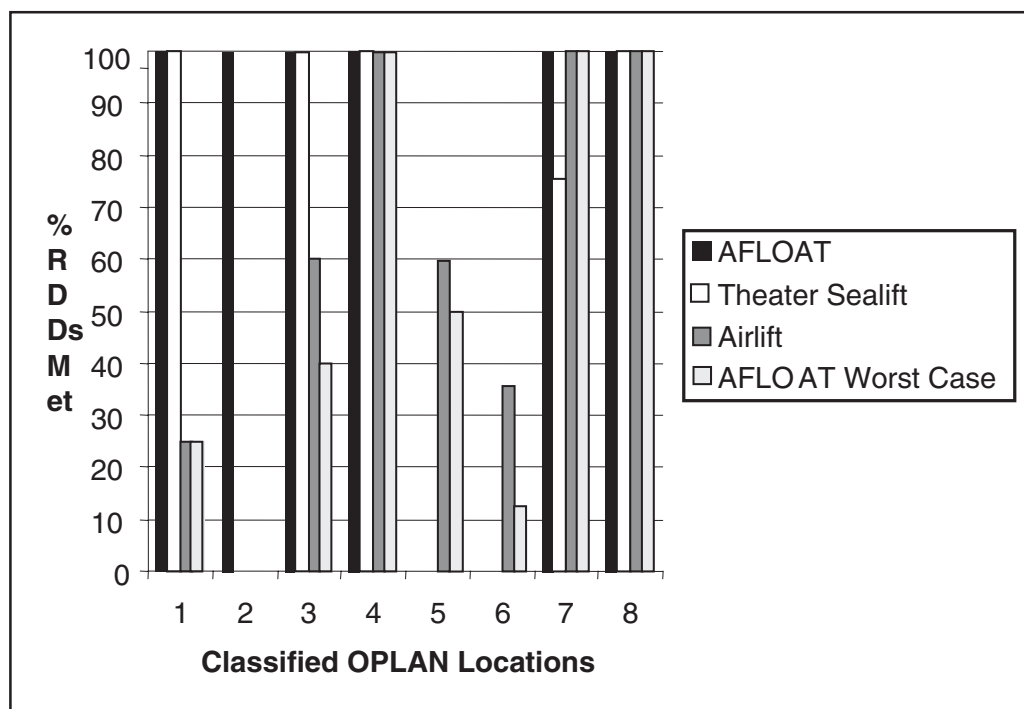


Figure 3. RDD Comparison with 7 Days of Strategic Warning²²

undoubtedly will be secondary transportation requirements. Those secondary transportation requirements have a bearing on the overall responsiveness of each option. The more secondary transportation legs required, the more opportunity for friction to impact success. In the purest case, a land-based location would be able to airlift its assets directly to the bare base. This involves a four-leg transportation concept (storage to truck, truck to airlift, airlift to truck, truck to destination).²⁷ However, as noted earlier, experience has shown that the limited availability of airlift means a more likely transportation scenario for land-based assets would be sealift. Using sealift for land-based assets results in a six-leg transportation scheme (storage to truck, truck to port, port to ship, ship to port, port to truck, truck to destination). Ship-based assets, in the best-case scenario, would require a three-leg transportation model (ship to port, port to truck, truck to destination). In a worst-case scenario, the assets would have to be downloaded at a port outside of the AOR and then airlifted. This would require a five-leg transportation model (ship to port, port to truck, truck to airlift, airlift to truck, truck to destination). Based on these results, afloat prepositioning would seem to require less secondary transportation in both a best-case and worst-case scenario.

Responsiveness considers how quickly each option can be implemented. Of the five forward support locations RAND identified, the Air Force already has facilities at each location. However, any WRM storage location would require two to three large warehouses with maintenance and office facilities. Some of these assets might be available at each location, but more realistically, each location would require construction or modification of some sort. It is safe to assume that some of the locations could be readied within a year, and in the worst-case scenario, a site could require a major military construction project consuming up to 5 years. For the sealift option, AFLMA, working with MSC, determined that building a single ship to handle WRM shortfall

	% Afloat	% Airlift
Without 7 Days of Strategic Warning	45	53
With 7 Days of Strategic Warning	63	69
With Warning and Using Rail	100	69

Table 1. Percentage of RDD Met with and without Strategic Warning²³

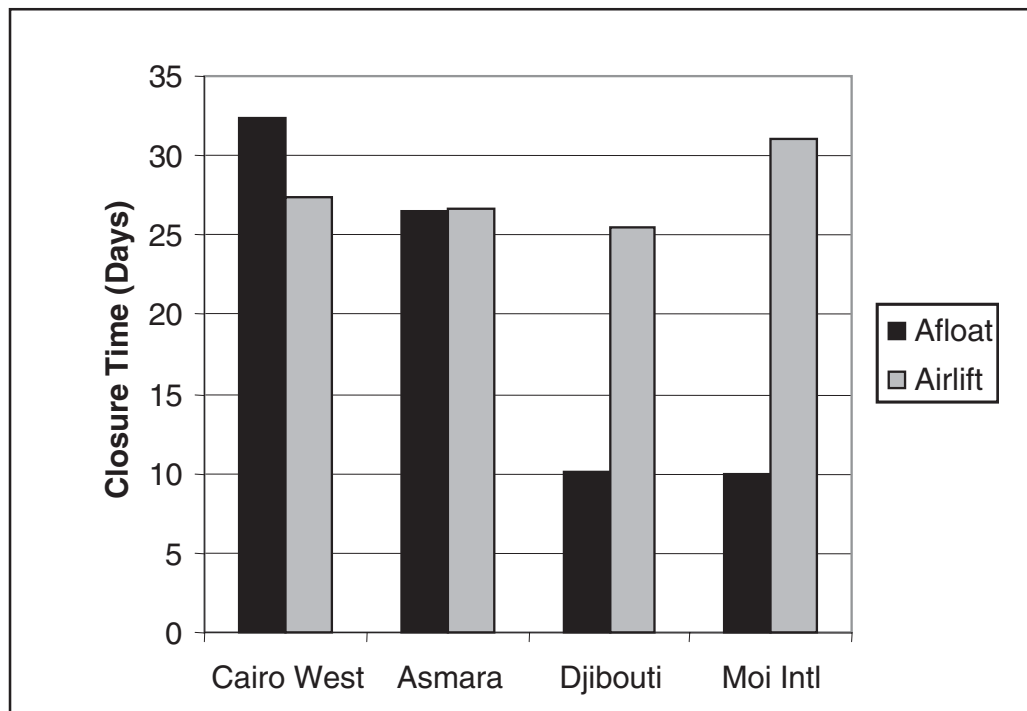


Figure 4. Closure Times—Southern Region of AOR

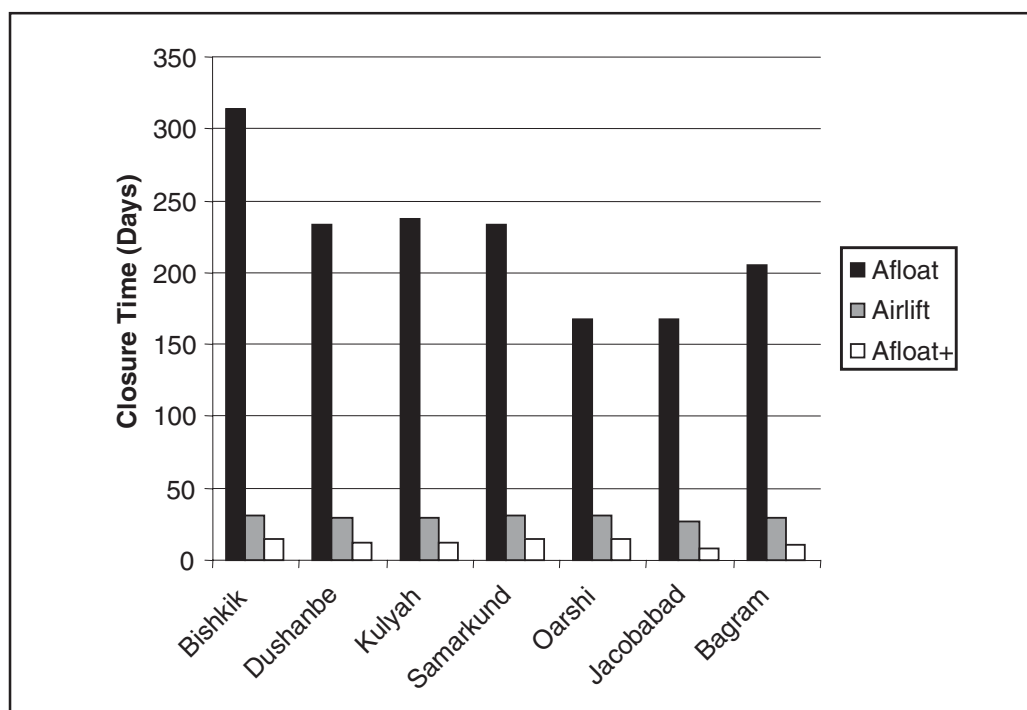


Figure 5. Closure Times—Northern Region of AOR

Type of Set	Requirement	Ready	Ready Rate
Housekeeping	87	52	60%
Industrial	15	4	27%
Flight line	40	12	30%

Table 2. Status of Bare-Base Harvest Equipment³⁰

	1997	1998	1999	2000
Number of WRM Requests	110	177	115	114
Number Approved	105	167	106	102
Percentage Approved	95%	94%	92%	89%

Table 3. Air Combat Command WRM requests³⁴

Year of Cycle	Afloat Costs	Land-Based Costs	Cost/Savings
1	\$83,006,696	\$89,617,435	-\$6,610,740
2	\$8,971,193	\$796,044	\$8,175,149
3	\$96,917,316	\$90,449,379	\$6,467,936
4	\$21,844,979	\$1,592,089	\$20,252,890
5	\$26,441,050	\$1,592,089	\$24,852,961

Table 4. Cost Comparison for Two-Ship Program Versus Two Warehouses³⁸

Year of Cycle	Afloat Costs	Land-Based Costs	Cost/Savings
1	\$85,698,890	\$89,617,435	-\$3,918,545
2	\$28,673,890	\$796,044	\$27,877,846
3	\$97,804,578	\$90,449,379	\$7,355,199
4	\$27,804,578	\$1,592,089	\$26,212,489
5	\$25,950,000	\$1,592,089	\$24,357,911

Table 5. Updated Cost Comparison Using Summary Data from April 2003 Report

requirements would take about 2 years. However, if the Air Force were willing to split the cargo in half to fit on two smaller ships, then several ships would be available for lease on the market at that time.²⁸ AFLMA recommended that if a second ship is added it would be prudent to stagger the lease of the second ship to avoid having both ships (and their cargo) require maintenance at the same time. In addition to the ready availability of the ships, the Marines at Blount Island Command (BIC) in Jacksonville, Florida, were receptive to sharing their maintenance facilities with the Air Force.²⁹ These Marines perform the maintenance on the maritime prepositioning ships. Outside of the infrastructure required for each plan, personnel would be needed to run the maintenance. The centralized nature of the afloat maintenance would make hiring a maintenance contractor quicker for the afloat option. In light of all these factors, the afloat option seems to be quicker to implement.

The last area to be evaluated under responsiveness deals with the ability of each option to counteract antiaccess strategies by potential adversaries. Redundancy is one way to counter antiaccess by forcing an adversary to attack a variety of targets simultaneously. The FSL concept offers the most redundancy, with five geographically separated locations from which to move assets. The disadvantage of the FSL concept is that the locations

are static and, therefore, lend themselves to more robust intelligence gathering by an adversary. Also, coalition partners can, over time, begin to perceive the assets stored on their soil as theirs. This issue was highlighted during Operations Northern and Southern Watch as the Turks and Saudis repeatedly tried to exercise control over US assets in their countries. The afloat option offers less redundancy, but the relative mobility of the ships offers the greater flexibility in terms of employment. In an extreme case, the ships could anchor at a secure port and offload the items for airlift to the needed location.

Readiness

Which option provides the best solution for meeting the readiness needs of the bare-base program? As previously discussed, components of this measurement include the amount of maintenance support needed for each option and how successful the maintenance program would be in terms of access to skilled technicians, spare parts, and the impact of environmental factors on the items. Readiness also considers how visible and measurable the assets would be under each option. These two factors center on the need for any ACS system to know where equipment is and whether or not it is ready to go. Several reports and studies have been done on the readiness of the bare-base and WRM program. The purpose of this article is to evaluate which concept affords the best opportunity at having a ready program, not to review specific issues of readiness. In 2001, the Harvest kits had readiness rates as shown in Table 2.

The primary reason that bare-base assets fall to low readiness levels is the constant demand for those assets. Even though the WRM program was developed technically for MTW scenarios only, the assets are, in fact, used much more frequently. A General Accounting Office (GAO) audit in 1998 found:

Since the Gulf War, items have been taken from the bare-base sets to support a large number of contingencies and exercises. In 1992, bare-base equipment was used to support two operations—Joint Endeavor in Bosnia and Provide Comfort in Iraq. In 1996, it was used to support 22 exercises and contingencies, ranging from the Dhahran bombing to Operation Desert Strike. Certain key items, such as tents, generators, and air-conditioners, have been used the most and replaced most frequently. For example, between January 1996 and April 1998, more than 3,000 tents and nearly 4,500 air-conditioning units—about the number required for 27 and 30 complete housekeeping sets, respectively—were deployed from storage locations in Oman and Bahrain to locations throughout the theater. Equipment from these operations has often been returned in poor condition and has required significant repairs, according to program managers. The contractor conducting reconstitution of Air Force equipment in the Gulf region told us that efforts to reconstitute assets and move them into storage to meet prepositioning objectives have been frustrated by the Air Force's continuing heavy use of these assets.³¹

Conversely, the GAO's review of the equipment prepositioned by the Army and Marine Corps on ships was found to be significantly more ready. The GAO commented on the Marines:

The Maritime Prepositioning Force—operational since 1984—has been given high marks for management by service auditors. In December 1996, the DoD Inspector General reported that Marine Corps systems provide reliable inventory data and that equipment afloat is maintained at high readiness levels. In April 1998, the Marine Corps reported that inventory fill and mission-capability rates were near 100 percent.³²

And while the same 1998 GAO audit did find problems with Army afloat assets, those problems stemmed from the fact that the items had either never been purchased in the first place or shipboard maintenance was significantly behind in readying the onboard assets because of manpower or space limitations.³³

What is apparent from these results is that land-based WRM assets lend themselves to more frequent use than ship-based assets. Would bare-base assets in an afloat prepositioned environment be more ready? Would the expense of docking the ship, contracting an offload, and using sailing fuel act as a constraint? Logically, the answer to these questions is yes. WRM requests for bare-base assets and their approval continue year after year. Table 3 depicts that data.

In addition to the fact that ship-based assets may be subject to less mission creep, other advantages for this mode of storage include a captive crew to maintain the bare-base assets while underway and a centralized, dedicated robust crew to perform heavier maintenance on the bare-base items while the ship undergoes hull certifications (normally every 30 months). The Air Staff uses the term *involute set* to fence off bare-base assets from the steady stream of use.³⁵ It may be that these sets would be most *involute* aboard a ship.

Using the forward support locations does have advantages in supporting readiness. First, FSL maintenance areas will not be space constrained the way a ship-based maintenance area would be. Second, getting spare parts to a land-based site should be easier compared to getting parts to a ship at sea. Additionally, forward support locations provide a maintenance capability (mainly space and infrastructure) that could be converted to

multiple combatant commanders or put the program in a *seam* with a support void. The best chance for success for an afloat option would be to designate an afloat asset as AOR specific, similar to the current concept used for Air Force munitions prepositioned on ships.

Force protection is also a consideration for supportability. No military mission can exist in the present environment without considerations for force protection. Many of our expeditionary sites have local hotels or facilities that could be used, but current planners will not even consider those assets because of force protection concerns.³⁷ Land-based locations can be protected but offer a static target for adversaries to plan against. Ship-based assets are much harder to interdict while underway and, like forward support locations, offer the flexibility of choosing from multiple ports for entry into the AOR. Port operations do present a force protection challenge, but their requirements are temporary in nature (unlike the constant protection needed for a land-based location).

Cost

Costs involved in each option will be assessed for both peacetime and wartime. Fixed and variable cost components will be identified for each option. AFLMA has done an excellent job in providing a cost analysis of afloat versus land-based storage. For peacetime, it found that the afloat option would be more expensive than adding two additional warehouses to the land-based WRM structure (Table 4).

Several caveats need to be made to the results from the October 2001 study. One, the first and third year costs for both programs included \$70M in fixed costs to fund the shortages in the bare-

The primary reason that bare-base assets fall to low readiness levels is the constant demand for those assets, even though the WRM program was technically developed for MTW-scenarios only.

centralized repair facilities (or even temporary billeting³⁶) once the bare-base assets are deployed.

Supportability

As previously discussed, supportability measures the ability to sustain an option over time. The first area for discussion is congressional funding. While the FSL option does have three US locations (Alaska, Guam, and Puerto Rico), the other two forward support locations (Diego Garcia and Great Britain) are located in foreign territories. Comparatively, the afloat option would use US-flagged ships, and the maintenance (following AFLMA's recommendation) would most likely be performed at BIC in Jacksonville. Congressional support for the afloat option is likely to be stronger because of the predominance of US assets.

The next area for consideration is service and DoD support. The forward support locations most likely would be aligned with specific combatant commanders. This alignment with AOR-specific OPLANs would provide solid support during the budget process and allow both combatant commanders and the Air Force to weigh in on funding issues. The afloat option would be multi-AOR committed, which could either strengthen support from

base program. Two, AFLMA's land-based model only included two warehouses added to a CONUS-based site. Therefore, estimating the costs for outfitting five forward support locations requires some extrapolation. Not every forward support location would need additional warehouses since some WRM storage already occurs at each of the sites.³⁹ But the costs for additional warehouses would probably be equal to, if not more than, the land-based model used by AFLMA. Finally, the afloat costs were reworked in a subsequent AFLMA study (released in 2003), which was developed much more and resulted in increased costs to the afloat option. The summary based on the new costs is shown in Table 5 and still includes the fixed cost of \$70M in the first and third year to fund shortages in the bare-base program.

In looking at the wartime costs of land versus afloat, AFLMA conducted extensive analysis. Its finding was that:

...during wartime the ship quickly paid for itself. Three hypothetical excursions were run involving conflicts in Southwest Asia, the Pacific Air Forces, and Air ForceE with afloat prepositioning resulting in savings of \$7.3M, \$12.1M, and \$6.7M, respectively, over land-based prepositioning.⁴⁰

Criteria	AFLMA Proposal Two Preposition Afloat Ships	RAND Proposal Five FSLs
Responsiveness		
Implementation timing	Immediate for first ship. Second ship staggered for logistics reasons to allow use of a central repair facility.	Immediate to 5 years. All but one of the proposed FSLs already has Air Force operations. However, additional infrastructure would be required to make all five locations fully mission capable.
Force closure capability	Equals FSL option with 7 days of strategic warning. Slower than FSL option when inland transportation is limited.	Faster if airlift is primary mode. Yet, Iraqi Freedom highlighted that, during MTW, airlift would most likely not be available. Slower when intratheater sealift is used or when afloat option has access to inland rail transportation.
Ability to counter antiaccess issues	Successful because of flexibility of ship positioning.	Successful because of redundancy of locations and collocation with coalition partners.
Global responsiveness	Yes (majority of the world's population lives within 650 nautical miles of a coastline).*	Yes (FSLs put most of world within 3,000 nautical miles of an FSL).
Secondary transportation requirements	Best case: three legs. Worst case: five legs.	Best case: four legs. Worst case: six legs.
Readiness		
Visibility and access	Static in nature. Lends to less use for other missions and more accurate visibility.	Dynamic in nature. Historically has resulted in the release of assets for other uses.
Maintenance support	Centralized on board ship and at port maintenance facility during hull recertification.	Decentralized at each FSL.
Supportability		
Congressional support	More apt than FSLs to be congressionally supported because all components of program are US assets.	Three of five FSLs identified are US territories. The other two are British. Would probably receive strong support.
Combatant commander	Possibly less support from combatant commanders if assets are not MTW dedicated.	Stronger since assets are MTW dedicated and in the AOR. Also, FSLs double as centralized repair facilities for the combatant commander.
Force protection	Easier because of maneuverability at sea. Requires temporary force protection measures for port operations.	Harder because of the static nature of locations. Requires constant force protection measures.
Coalition	Not coalition engaging.	Coalition engaging but may lead to perception of host-country ownership.
Cost		
Peacetime costs	More expensive.	Less expensive.
Wartime costs	Less expensive.	More expensive.
*Dr Scott Bowden, Forward Presence, Power Projection, and the Navy's Littoral Strategy: Foundations, Problems, Prospects, IRIS independent research, 1997 [Online] Available: http://www.irisresearch.com/littorals.htm .		

Table 6. Summary of Analysis

Once again, these numbers are not specifically conclusive to the emphasis of this article because of some limitations. One, AFLMA based the land-based costs on airlifting all assets from Holloman AFB, New Mexico. Two, only a single ship was used in the cost analysis. Based on the force closure estimates used in the April 2003 AFLMA study, it would seem that the cost of transporting land-based assets would be less because of the probable use of intratheater sealift versus airlift.

The research done by AFLMA is thorough enough to offer two conclusions concerning costs. One, the peacetime cost of using a ship will be more than storing the same assets in a land-based warehouse. Two, having the assets on a ship when an execution order comes reduces the transportation cost of moving the same assets from a land-based warehouse. The one caveat to that would be if the assets were collocated at the actual fighting location. However, the five forward support locations recommended by RAND are not bare-base locations that would require these assets.

The previous discussion of each criteria and the relative strengths and weaknesses of each option are summarized in Table 6.

Conclusions

Teamwork allows us to be an effective fighting force—a rapid expeditionary force capable of deploying anywhere in the world in a minimum of time and in austere conditions—not operating from where we are stationed, but from where we are needed, not when we can, but when we must.

—General Michael Ryan, USAF

Successful expeditionary operations require a bare-base capability with an ACS system that can get them to a contingency location rapidly. A successful bare-base strategy must be responsive, ready, supportable, and achievable with respect to

cost. The Air Force has struggled with meeting the vision of its Chief of Staff in terms of establishing and sustaining rapid bare-base operations. The two study agencies have attempted to provide solutions to this problem. AFLMA looked at the cost and risks to OPLAN execution of adding an afloat prepositioned capability, and RAND looked at basing strategies. While the RAND study was not specifically developed to look at the storage and maintenance of bare-base assets, its proposal to incorporate five forward support locations as part of a global Air Force basing infrastructure provided a potential for using these locations as a substitute for an afloat option. AFLMA conducted extensive cost and risk analysis comparing a ship-based concept against a land-based storage location. In the AFLMA study, the storage location used for analysis was not one of RAND's proposed forward support locations. However, the costs and risks measured in the study should have been more favorable toward an FSL concept since the land-based location used by AFLMA was closer to the conflict location than any of the five forward support locations. Yet, in measures of cost and risk, the afloat option proved to be competitive with the land-based option. In addition to the cost and risk measures evaluated by AFLMA, this article also tried to quantify a number of additional issues related to responsiveness, readiness, and supportability.

In the end, neither option stands out as the unequivocal choice for the Air Force to store and maintain bare-base assets. Senior leaders to whom cost is a primary issue, most likely, would choose the land-basing strategy. Senior leaders concerned with readiness, most likely, would see the afloat option as the answer. This article advocates that an afloat option has sufficient merit across the spectrum of readiness, responsiveness, supportability, and cost to make it the better choice over the land-basing strategy. However, to strengthen the afloat option's ability to enable the Air Force to project expeditionary forces in a global environment, several recommendations can be made.

Recommendations

First, it is important to lease two readily available ships rather than delay for the construction of a specialized ship. It may mean temporarily leasing a less-than-optimum vessel while waiting for a better match to become available on the market. It is also important to stagger the leasing (as recommended by AFLMA). This avoids the proverbial *eggs in one basket* and allows for a single port to be used for maintenance (because of the staggered nature of the hull certifications).

Second, it is important to blend into the existing operations of the Marines at Blount Island Command. The Marines have been evaluated most favorably by the DoD and GAO and, obviously, know how to maintain the ships and assets on the ships. One of the key strengths of the afloat option was the speed with which it could be implemented. That evaluation was based on the use of Blount Island facilities.

Third, even though Blount Island should be the primary maintenance location, it would be beneficial to set up overseas maintenance locations. Recommendations include Diego Garcia, Singapore, and Qatar. These locations offer opportunities for coalition building and practice with port operations for key regional access.

Fourth, the ships should be stocked first with the *inviolable* sets deemed critical by the Air Force. The constant use of bare-

base assets for everything from humanitarian operations to small-scale contingencies has decimated the program. The Air Force is smart to recognize that a certain capability has to be deemed inviolable, because the current system has shown a reluctance to deny requests for non-MTW use of bare-base assets. The Marines and the Army have proven that ship-based WRM assets maintain a higher degree of readiness than land-based storage.

Fifth, the ships should be MTW dedicated. Combatant commander sponsorship can add issues with coordination during steaming and port operations, but it also provides a valuable ally in the fight for resources. Additionally, it allows for the assets to be evaluated in readiness metrics (that is, SORTS) to keep senior leaders focused on the program. Realistically, the strength of the afloat option is that it provides a global response, but the threats that drive the need for a bare-base capability are primarily regional, and the ships can be very easily tied to an MTW scenario.

Sixth, AFLMA's April 2003 study proposed sourcing WRM assets for the preposition ships from currently assigned CENTCOM assets. That initiative should go beyond CENTCOM and include worldwide WRM assets. This recommendation stems from two facts. One, the afloat option makes the most sense with two ships, and it may not be possible to find enough CENTCOM assets to fill two ships. Two, since the ships should be aligned with a combatant command, it would make more sense to have one dedicated to Pacific Command and the other to CENTCOM.

Finally, the afloat option is not a panacea. Some land-based storage is prudent and necessary. Land basing with long-time coalition partners has advantages that go beyond the efficiencies of good logistics. As the Air Force begins to develop its *lily pad* strategy for Eastern Europe and other regions of instability, it may make sense to have limited bare-base storage in those areas.


Notes

1. *United States Air Force Posture Statement 2003*, 25 Feb 03, 10.
2. Air Force Doctrine Document 1, *Air Force Basic Doctrine*, 17 Nov 03, 88.
3. James R. Galluzzi, "The Bare-Base Program—History and Analysis," research study, Air Command and Staff College, Maxwell AFB, Alabama, May 74, 9.
4. The National Security Strategy of the United States of America, 17 Sep 02, 16.
5. *United States Air Force Posture Statement 2003*, 10.
6. *United States Air Force Posture Statement 2003*, 17.
7. Warm basing describes locations having a developed infrastructure to support air operations, as well as a variety of prepositioned assets. These bases were routinely used for deployments to help prepare forces for their eventual use in war.
8. Lionel A. Galway, et al., "Supporting the EAF: A Global Infrastructure," *Combat Support: Shaping Air Force Logistics for the 21st Century*, Aug 03, 32.
9. Robert S. Tripp, et al., "Supporting Aerospace Expeditionary Forces: Lessons from the Air War Over Afghanistan," RAND Draft report, 64.
10. Tripp, 65.
11. Galway, 32.
12. Galway, 32-33.
13. *Ibid.*
14. David A. Shlapak, et al., "Global Access: Basing and Access Options," *Combat Support: Shaping Air Force Logistics for the 21st Century*, Aug 03, 115.
15. Shlapak, 114.
16. Paul E. Boley II, "Cost-Benefit Analysis of Afloat Prepositioning of Nonmunitions War Reserve Materiel," Air Force Logistics Management Agency Report LX200001300, Oct 01, 1.

(Continued on page 47)

44. US Strategic Bombing Survey, Interview No 56, 4.
45. Baumbach, 56.
46. Milward, 48-49.
47. Overy, 187.
48. Overy, 177.
49. Baumbach, 34.
50. Lee, 256.
51. Faber, 141.
52. Baumbach, 171.
53. Price, 183.
54. *The Rise and Fall of the German Air Force, 1933-1945*, New York: St Martin's Press, 1983, 407.


55. Baumbach, 30.
56. Milward, 172.
57. US Strategic Bombing Survey, Interview No 56, 4.
58. Lee, 266.

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(Improving Bare-Base Agile Combat Support from page 15)

17. Boley, 55.
18. Todd Groothuis, "Afloat Prepositioning of Nonmunitions WRM Phase II," Air Force Logistics Management Agency Report LX200125700, Apr 03, i.
19. Groothuis, 22.
20. Groothuis, 24.
21. *Ibid.*
22. Groothuis, 25.
23. *Ibid.*
24. Groothuis, 26.
25. *Ibid.*
26. Groothuis, 27.
27. The final leg of truck to destination is descriptive of the fact that once an item arrives at an aerial port it still has to be moved to an operating location.
28. Groothuis, 15.
29. Boley, 27.
30. HQ Air Force/Installation and Logistics Briefing, "Bare-Base Systems Status Update—Harvest Falcon and Harvest Eagle," Slide 20 [Online] Available: <http://140.185.52.73/ilx/ilxx/wrm/index.html>, May 03, slide 20.


31. GAO, "Military Prepositioning: Army and Air Force Programs Need to Be Reassessed," GAO/NSIAD-99-6 Nov 98, 41.
32. *Ibid.*
33. *Ibid.*
34. HQ AF/IL Bare-Base Systems Update, slide 34.
35. HQ AF/IL Bare-Base Systems Update, slide 33.
36. The WRM facility at Al Udeid, Qatar, was used for lodging during the initial stages of Enduring Freedom while the Harvest Falcon kits were being readied for use.
37. During the buildup for Iraqi Freedom, planners were unwilling to discuss the use of local hotels in Doha, Qatar, to allow for a faster force closure at Al Udeid AB. Instead, a 4-month delay was allowed for the contracting of tents, latrines, and other infrastructure additions to Al Udeid.
38. Boley, 42.
39. HQ AF/IL Bare-Base Systems Update, slide 14.
40. Boley, 54.

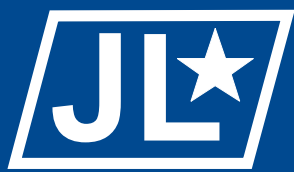
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(Creative Approaches to Improving Segments of the Defense Transportation System continued from page 33)

- RDD of 444 indicates handling service for customers collocated with the storage activity or for locally negotiated arrangements. An RDD of 555 indicates exception to mass requisition cancellation, expedited handling required. An RDD equal to 777 indicates expedited handling required for reasons other.
21. DoDR 4140.1-R.
 22. Author's telephone interview with TACC/XOGE, 17 Feb 04.
 23. Author's e-mail interview with HQ USTRANSCOM, J3-RR, 18 Feb 04.
 24. Capt Leigh Method, letter report, Time-Definite Delivery Estimates for DoD Air Shipments, AFLMA Project Number LT200011000, Oct 00, 2.
 25. Author's telephone interview with HQ USTRANSCOM/TCJ4, 28 Jan 04.
 26. Area A. To locations in the vicinity of Alaska (Elmendorf AFB), Hawaii (Hickam AFB), North Atlantic (Thule AB, Greenland, and NAVSTA Keflavik, Iceland), and the Caribbean (NAS Guantanamo Bay, Cuba, and NAVSTA Roosevelt Roads, and Puerto Rico). Area B. To locations in the vicinity of United Kingdom (RAF Mildenhall, England) and Northern Europe (Ramstein AB, Germany and Lajes AB, Portugal, Azores). Area C. To locations in the vicinity of Japan (Yokota AB and Kadena AB, Okinawa), Korea (Osan AB), Guam (Andersen AFB), Western Mediterranean (Spain (NAVSTA Rota), and Italy (Aviano AB, NAS Sigonella, Olbia, and Naples). Area D. Hard lift areas—all other destinations not listed as determined by USTRANSCOM; for example, low-use Alaska (Eielson AFB, Adak, Eareckson AS, and Galena), low-use Japan (Itazuke, MCAS Iwakuni, Misawa AB), low-use Korea (Kunsan AB and Kimhae), Indian Ocean (Diego Garcia), New Zealand (Christchurch), Singapore (Paya Lebar), Greece (Souda Bay), Turkey (Incirlik AB), Southwest Asia (Saudi Arabia (Dhahran and Riyadh), Kuwait, Bahrain, Oman (Fujairah), and Israel (Tel Aviv).

- The time standards for port of debarkation for Area D are lower than the other areas. EXP. Commercial door-to-door air service is only for OCONUS shipments that are transportation priority 1 or 2. It is an alternative service to be used when established AMC channel service is not adequate. The intransit-to-theater standard for commercial door-to-door air service (that is, segment H) encompasses the total time for contract transportation rather than individual nodes.
27. Table AP8.T1 from Appendix 8 of DODR 4140.1-R.
 28. Appendix 8 of DODR 4140.1-R
 29. US Government DoD Airlift Rates, Passenger and Cargo Channel Rates Effective 1 Oct 03 through 30 Sep 04 [Online] Available: <http://public.amc.af.mil/fm/dodrates.doc>(<http://public.amc.af.mil/fm/fy04dod.pdf>).
 30. Roger O. Crockett, "Let the Buyer Compare," *Business Week*, 3 Sep 01, Issue 3747.
 31. GAO Report 04-305R, Defense Logistics: Preliminary Observations on the Effectiveness of Logistics Activities during Operation Iraqi Freedom, 18 Dec 03, 2.
 32. GAO Report 04-305R, Preliminary GAO Observations on Effectiveness of Logistics Activities During Operation Iraqi Freedom, 18 Dec 03, Enc 1, 22.

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